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TRANSFUSION

EMERGENCY TRANSFUSION AND DAMAGE CONTROL RESUSCITATION

Finger thoracostomy: Significant risks and unproven benefits in prehospital settings

Yael Mozer-Glassberg[1,2] | **Irina Radomislensky**[3,4] | **Avi Benov**[4,5] | **Ofer Almog**[4,6]

[1]Institute of Pediatric Gastroenterology, Nutrition and Liver Diseases, Schneider Children's Medical Center of Israel, Petah Tikva, Israel

[2]Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

[3]The National Center for Trauma and Emergency Medicine Research, The Gertner Institute for Epidemiology and Health Policy Research, Sheba Medical Center, Tel HaShomer, Israel

[4]Israel Defense Forces Medical Corps, Surgeon General's Headquarters, Ramat Gan, Israel

[5]The Azrieli Faculty of Medicine, Bar-Ilan University, Safed, Israel

[6]Department of Military Medicine, Faculty of Medicine, Hebrew University, Jerusalem, Israel

Correspondence
Yael Mozer-Glassberg, Institute of Pediatric Gastroenterology, Nutrition and Liver Diseases, Schneider Children's Medical Center of Israel, Petah Tikva, Israel.
Email: yaelmozer10@gmail.com

Abstract

Background: Trauma is a leading cause of preventable death, with a significant portion of trauma deaths occurring in the prehospital setting. Interventions such as chest drainage may play a critical role in managing life-threatening conditions but face challenges due to poorly defined indications and reliance on anecdotal evidence rather than rigorous studies. Among chest drainage techniques, finger thoracostomy (FT) is a well-described, but controversial, method for decompressing the pleural cavity in emergencies like tension pneumothorax or hemothorax. Despite its simplicity and minimal equipment requirements, FT carries risks, including bleeding, infection, organ injury, temporary effects, and procedural failure.

Study Design and Methods: This study examines eight FT procedures performed by Israel Defense Forces providers during the 2023–2024 "Swords of Iron" War in Gaza.

Results: All patients sustained severe penetrating injuries, with mixed outcomes. One case highlighted severe complications, including infection and empyema weeks later. Additionally, challenges in maintaining up-to-date knowledge and adherence to protocols among reservists led to unauthorized FT procedures, emphasizing the dangers of improvisation without evidence.

Discussion: Our findings, coupled with limited evidence for FT's effectiveness in prehospital settings, raise questions about its appropriateness in trauma care. These concerns highlight the critical importance of adhering to validated and evidence-based protocols in all aspects of medical practice. Deviating from such protocols not only introduces unnecessary risks but also undermines the standardization essential for optimal patient care. Further research is needed to clarify the role, if any, of FT in prehospital trauma management.

Abbreviations: CT, computerized tomography; FT, finger thoracostomy; GSW, gunshot wound; ICU, intensive care unit; IDF, Israel Defense Forces; IDF-MC, Israel Defense Forces Medical Corps; IDF-TR, IDF-trauma registry; ISS, injury severity score; KIA, killed in action; MTLS, Military Trauma Life Support; SOIW, Swords of Iron War.

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1 | PREFACE

Rapid and effective interventions are critical to trauma patients' survival. Given that a significant portion of trauma deaths occur in the prehospital arena, the development, adaptation, and critical evaluation of lifesaving interventions by prehospital providers is essential.[1] Unfortunately, this process is very challenging. Data about point-of-injury and prehospital care provided to these casualties are incomplete, thus limiting the ability to learn and adapt. As a result, many of the techniques used today did not develop through rigorous scientific studies but were adopted out of necessity, based on what was considered to be common sense. These conditions create fertile ground for the preservation of traditions and the adoption of techniques and approaches based on opinions and "the experience of others," and a significant difficulty in leading changes or updating approaches. At the same time, this environment also fosters the rapid adoption of popular techniques, even in the absence of supporting data regarding their superiority over other methods.

Chest drainage is considered an emergency intervention, aimed at relieving pressure within the pleural cavity due to air or hemorrhage (e.g., tension pneumothorax, hemothorax, or hemopneumothorax). This mechanism is considered to be a "preventable" cause of death, and thus, relieving the pressure is perceived as a lifesaving intervention.[1] However, poorly defined indications and inconsistent data collection have fueled discussions regarding its place in the prehospital arena for many years. Among the techniques developed for chest drainage following injuries, finger thoracostomy (FT) stands out as a particularly compelling method.

A review of the literature highlights apparent inconsistencies in the indications for this procedure, significant variation in how its necessity is assessed, and a non-negligible rate of complications. Despite these issues, efforts to refine its application continue.

Finger thoracostomy (FT) involves inserting a finger through a small incision in the chest wall to relieve air or fluid pressure. Historically, the technique has its roots in emergency medicine practices dating back to the early 20th century, when physicians sought immediate solutions to life-threatening chest injuries on the battlefield and in emergency settings. Initially developed as a last-resort measure in-hospital settings, it has garnered renewed attention in recent years for its potential applications in prehospital care.[2]

Finger thoracostomy is referenced in the Western Trauma Association guidelines for the management of traumatic pneumothorax, where it is noted as an acceptable method for rapid decompression in life-threatening situations, typically followed by chest tube insertion. Despite its inclusion, the evidence supporting FT in these guidelines is limited, positioning it as a last-resort procedure for critical emergencies rather than a standard prehospital intervention.

The rationale behind FT lies in its ability to rapidly decompress the pleural space, providing immediate relief from pressures that compromise respiratory and cardiovascular function. Unlike traditional chest tube insertions, which require more extensive skills, preparation, and equipment, FT can be performed with minimal training and resources, making it theoretically more relevant for medics and first responders who often operate in austere environments.

The technique was never adopted by the Israel Defense Forces (IDF) Medical Corps (IDF-MC) and is not taught as part of its Military Trauma Life Support (MTLS) training. However, several FTs were performed by IDF providers during the "Swords of Iron" War (SOIW) in Gaza.

This article describes a series of patients who underwent this procedure, highlighting the risks and the caution warranted before using this technique to promote shared learning and improve the care provided to casualties in the prehospital arena.

2 | METHODS

2.1 | Study design

This is a retrospective registry-based study. Demographic and clinical data were extracted on trauma casualties who underwent FT throughout the first year of the ground operation in Gaza during the SOIW (between October 27th, 2023, and November 1st, 2024).

2.2 | Data sources

The IDF-trauma registry (IDF-TR) is a digital web-based system that documents prehospital care by IDF's advanced life support (ALS) teams for traumatic injuries. The ALS providers (paramedics or physicians) in those teams fill a casualty card containing demographics, injury location and type, and prehospital interventions performed. Within 24 hours, the card data are entered into the IDF-TR and supplemented by detailed entries performed by the on-scene providers. The data undergo quality assurance by the Trauma and Combat Medicine Branch (TCMB) staff in the IDF Surgeon General's Headquarters.[3] TCMB personnel are also in charge of adding data from hospitals and postmortem examinations. The

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TABLE 1 Patients characteristics and outcomes.

	Mechanism of injury	Clinical description	Presence of thoracic injury per CT[a]	ISS	Side of FT	Performed by	Care-giver's type of service	Mortality and adverse outcomes
1	GSW to the Lt. thorax	Shock signs in the presence of thoracic injury	Yes	16	Bil.	Aeromedical evacuation physician	Reserve service	Empyema (Rt. thorax)
2	GSW to cervical region and Lt. thorax	Desaturation in the presence of thoracic injury	No	34	Lt.	Ground evacuation physician	Reserve service	-
3	Fragmentation injury d/t an explosion	Traumatic cardiac arrest	No	16	Bil.	Ground evacuation physician	Reserve service	KIA
4	GSW to the upper back	Traumatic cardiac arrest	Yes	18	Bil.	Ground evacuation physician	Reserve service	KIA
5	Fragmentation injury d/t an explosion	Traumatic cardiac arrest	Unknown	43	Lt.	Ground evacuation physician	Reserve service	KIA
6	Fragmentation injury d/t an explosion	Shock signs in the presence of thoracic injury	Yes	26	Lt.	Ground evacuation physician	Reserve service	-
7	Fragmentation injury d/t an explosion	Penetrating injury to the abdomen	No	17	Bil.	Ground evacuation physician	Reserve service	-
8	Fragmentation injury d/t an explosion	Traumatic cardiac arrest	Yes	22	Bil.	Aeromedical evacuation physician	Reserve service	KIA

Abbreviations: FT, finger thoracostomy; GSW, gunshot wound; KIA, killed in action; ISS, injury severity score.
[a]Either at the hospital or postmortem.

TCMB physicians calculate the injury severity score for the casualties according to the hospital diagnosis or the injuries identified in the postmortem computed tomography identified by a forensic radiologist.

3 | RESULTS

During a period of one year (October 27th, 2023–November 1st, 2024), 4152 casualties were treated by IDF-MC medical teams in Gaza and recorded in the IDF-MC trauma registry. Of these, 523 of the casualties suffered from penetrating injuries to the thoracic area (mostly fragmentations from explosions). Eighty-eight of the patients underwent at least one invasive thoracic procedure: needle decompression, chest drain insertion, or FT. Eight of the casualties, all of them male servicemembers, underwent FTs. Seven cases occurred during the first two months of the ground operation, while the eighth occurred six months into it. All the FTs were performed by reservists—civilian physicians who only receive periodic updates in military medicine and were drafted as the war broke. Four of the casualties that underwent FT died from their injuries before arriving at the hospital. All the casualties who underwent FT sustained severe injuries (with an injury severity score [ISS] greater than 15), including three who were considered critical (ISS greater than 24), of whom two survived. Retrospectively, only four (50%) of the FT group had evidence of significant penetrating thoracic injury confirmed by Computerized Tomography (CT) (two of them survived). Table 1 describes the characteristics and outcomes of those casualties.

One of the cases stands out as resulting in an unusual complication. It was this case that brought this series to our attention and encouraged us to report it. A 21-year-old male soldier was wounded from a gunshot to the left thorax. At the point of injury, he received advanced volume resuscitation due to hemodynamic shock signs and was intubated and evacuated by helicopter to a trauma center. During the 12-min flight to the hospital, the onboard physician decided to perform bilateral finger

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thoracotomies due to the mechanism of injury and hemodynamic instability. Upon arrival at the hospital's trauma bay, blood products were administered, and bilateral chest drains were inserted. A computed tomography scan demonstrated hemopneumothorax in the left hemithorax, broken 4th and 5th ribs, lacerations, and tears of the LUL and LLL with minor parenchymal bleeding. In the right hemithorax, there was a small pneumothorax with no other findings. The patient was admitted to the intensive care unit (ICU). Two days after the injury, the chest drain from the right thorax was removed, and the patient was extubated. The patient did not need any surgical treatment. The chest drain from the left side was removed a week after the injury. A follow-up x-ray demonstrated evidence of left pulmonary contusion and the resolution of the pneumothorax. The patient was discharged from the hospital 8 days after the injury. Routine follow-ups showed improvement in the injury and lung functions but a recurrent small amount of pleural effusion on the right side. Eight months after his injury, the patient suffered from right-side discomfort during breathing and pleuritic pain and was admitted to a hospital. The patient underwent decortication of the right lung. Aspergillus was isolated from the pleural tissue and pleural effusion.

4 | DISCUSSION

Finger thoracostomy is an infrequently utilized procedure in trauma care with the aim of rapidly decompressing the pleural space in cases of tension pneumothorax or hemothorax. The rationale behind performing FT is based on the urgency of relieving intrathoracic pressure that can compromise respiratory and cardiovascular function. Data demonstrating training providers to perform FT swiftly are relatively simple, without the need for dedicated equipment for tube thoracostomy, and the necessity to perform the time-consuming suturing and securing. Furthermore, it provides tactile feedback, allowing the clinician to confirm pleural entry and potentially avoid some of the placement errors seen in needle decompression.[2]

Despite these perceived (primarily technical) advantages, the procedure carries significant risks, including infection, organ injury (lung, liver, spleen), bleeding, and incorrect placement. The large thoracic opening created by this procedure may also increase the risk of an open pneumothorax, particularly when compared to formal chest drains equipped with one-way valves. Insertion-related complication rates have been reported at 5%–10%, with severe outcomes such as subcutaneous placement or damage to thoracic structures being well documented.[4]

Additionally, even if performed correctly initially, FT carries, by nature, the risk of failure to adequately decompress the pneumothorax. Without a tube to ensure the opening in the thoracic cavity remains patent, the tissues around the cut can block air drainage through the cut, resulting in a recurrence of tension pneumothorax[5] As a result, placing a formal chest drain upon hospital arrival is customary, subjecting patients to additional invasive procedures. Although the risks of FT may be significant, none of the deaths described can be associated with the procedure. It is also worth mentioning that no clinical improvement can be associated with the procedure in all eight of the cases.

Infection risk remains a significant concern, as demonstrated by the aforementioned case in which an infection occurred on the contralateral side of the injury, likely as a result of the procedure. This is particularly troubling in less sterile prehospital environments. While infection rates reported in studies are generally low, the data are limited, and follow-up periods often focus only on in-hospital outcomes up until hospital discharge (or chest tube removal).[6-8] Most studies emphasize immediate procedural success and complications rather than long-term outcomes. This limits the ability to accurately assess the actual complication rates, as some develop infection (or, like the case described here) empyema, weeks or months after the insertion. Similarly, additional long-term complications, such as pleural adhesions, are underestimated without prolonged follow-up.

When considering alternatives, needle decompression is often discussed as a less invasive option. However, needle thoracostomy has shown higher failure rates, particularly in cases where the chest wall is thick and carries a significant risk for iatrogenic injuries. It is also considered a temporary rather than definitive treatment and should be followed by a tube thoracostomy according to the IDF-MC clinical practice guidelines as well as other common protocols.[9,10] Thus, many question its effectiveness and place in caring for these casualties. In the case series brought here, the providers were physicians who were fully capable of performing this intervention. They still chose to prefer the FT, a procedure for which the evidence behind it is weak (at best), over needle decompression, thus supporting these claims.[11,12]

Tube thoracostomy is considered the preferred emergency intervention for chest drainage of trauma patients.[9] Furthermore, the procedure requires not only dissection and chest tube insertion but also suturing around the tube to secure it in place and additional bandaging—all time and skill-consuming, thus presenting a challenge, especially for the less experienced providers (medical doctors included). Injury to internal organs, subcutaneous placement, and infectious complications are also some of the known complications of this procedure.[9,10]

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There is currently no robust clinical evidence supporting the superiority of FT over these alternatives. Some data even suggest that the significant (theoretical) advantage of allowing for quicker drainage does not translate into shorter scene times.[9] Much of the rationale for its use is based on anecdotal success and a perceived need for a rapid, tactile solution. Still, it is apparently appealing to some providers, especially in military and prehospital contexts.

Our case series highlights another challenge: ensuring consistent medical knowledge and protocol adherence, especially among reservists who choose to perform a procedure not part of the organization's doctrine but something they might have encountered in their civilian capacity. While representing a small fraction of the cases, these providers, senior and experienced, once stressed, chose to perform this unauthorized procedure based on their "experience" and "Beliefs" This challenge is not unique to FT or the IDF and underscores the need for relentless education and the implementation of standardized practices. It also serves as a reminder that every action comes with a cost, and not everything possible is necessarily advisable or worth pursuing.

5 | CONCLUSION

While FT is appealing for draining the thoracic cavity in the prehospital setting, the procedure carries significant risks. Its use is often justified by the urgent need to decompress the pleural cavity in life-threatening situations. However, in the absence of strong evidence supporting its benefits over alternatives and in lieu of the significant risks involved, careful consideration should be given before incorporating FT into trauma protocols. FT is not included in the IDF-MC protocols for draining the chest. We recommend that those who consider adopting this technique should consider limiting it strictly to the very uncommon situations where immediate, lifesaving intervention is strictly necessary, and other options are impractical. There remains a pressing need for more research to evaluate its true effectiveness.

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CONFLICT OF INTEREST STATEMENT

The authors have disclosed no conflicts of interest.

ORCID

Yael Mozer-Glassberg https://orcid.org/0000-0003-2577-6860
Irina Radomislensky https://orcid.org/0000-0001-6799-0633
Avi Benov https://orcid.org/0000-0003-1901-9038
Ofer Almog https://orcid.org/0000-0002-0293-681X

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